Department of
Environmental Protection
Bureau of Land & Water Quality September 2002

O&M Newsletter

A monthly newsletter for wastewater discharge licensees, treatment facility operators and associated persons

Energy in Wastewater Treatment Facilities

Our Energy article in this *O&M News* is the second of two focusing on alternative energy sources. This month, we discuss hydropower and micro turbines. This is the next to last article in our energy series. If you have any ideas for serial articles like this or any other topics you would like to see covered, please send them along to me at dick.darling@state.me.us.

Effluent Hydropower

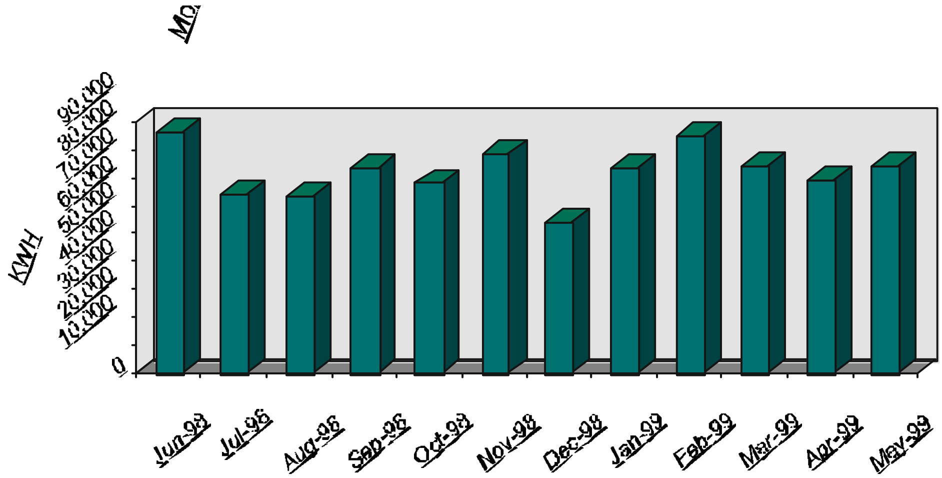
Flowing water creates energy, which can be captured and turned into electricity. This is called hydropower. The energy of falling water is converted to mechanical energy by means of a turbine. The most common type of hydropower plant uses a dam on a river to store water in a reservoir. Water released from the reservoir flows through a turbine, spinning it, which in turn spins a generator, which produce electricity. In the case of a wastewater treatment facility, the effluent is the flowing water. The energy produced depends on the distance the wastewater falls and the flow rate of the wastewater. The larger the flow and the further the wastewater falls, the more cost effective the system. In the late 1970s and early 1980s, two wastewater facilities in New England operated an effluent driven turbine, each with limited success. The paragraphs below describe the effluent driven turbine that was used at the Montague, Massachusetts wastewater treatment facility. Although each facility is distinct, you can use the following formula to calculate the potential energy from an effluent driven turbine.

Potential Power (kW)= Head (feet) x flow (gpm) x 0.18(efficiency)
kWh/yr = Power x 8760 hrs/yr

As with a wind system, power generated with an effluent driven turbine can be used directly or sold back to a utility. Your utility or state energy office may assist with financing or technical assistance for such a project.

Montague, MA WWTF

The Montague facility is a conventional activated sludge facility designed for an average flow of 1.865 million gallons per day (MGD). Average flow is currently 1.03 MGD. Energy use for 1998/1999 is shown below.



Total energy use for 1998 was 862,560 kWh for a total cost of $69,338. This amounts to an average energy cost of $0.080/kWh.

In the last few years, the facility has been aggressive pursuing energy conservation projects in the facility. These projects include:

Installing variable speed drives and automatic blower controls on their aeration system. This project is expected to go on line by the end of 1999 and is projected to reduce annual energy costs by approximately $30,000 (per energy evaluation performed in 1998)

Replacing one of the existing 30 hp plant water pumps with a 15-hp unit. Based on a previous evaluation, this improvement is expected to save $5,688.

In addition to the energy projects currently being installed, the facility has also had experience with a small hydro generator that was installed 15 years ago. The system was not ideal for a hydro generator and had flooding problems when the river elevation increased during certain times of the year, and would also get clogged with leaves occasionally. The generator has not been used in five years and must be reviewed in more detail to determine if a hydro generator could be applied more effectively.

Although energy use is expected to be reduced significantly with the aeration and plant water system projects, upon a review of the facilities operation and maintenance expenses, *sludge disposal costs were over four times higher than annual energy costs.* Woodard & Curran considers this facility to be an excellent candidate for an *electrotechnology*. Electrotechnologies involve the application of equipment that may increase energy costs, but provide enough savings in other operational expenses to justify the recommended improvement.

Based on annual sludge disposal costs of $328,000, a sludge drying system may be a cost-effective project. Woodard & Curran has recently installed a dryer in its Gloucester, MA WWTF and is expecting to reduce disposal costs by over 60% (net saving take into account energy and maintenance expenses). This needs to be reviewed in more detail to determine the best approach for the Montague facility.

Micro turbines

Micro turbines are adaptable low emission power generation systems. A natural gas turbine driven generator, coupled with an electronic control module, allows the unit to operate alone or connected to the grid. It produces electricity efficiently while emitting very low levels of air pollutants. They are low maintenance, can operate using a variety of fuels, and produce a clean oxygen rich heat exhaust that may be used as a heat source for the facility. A preliminary evaluation of the application of a micro turbine at the Veazie, Maine wastewater treatment facility is shown below. For many facilities, the supply and cost of natural gas is critical to the cost evaluation. However, there are now several gas pipelines in New England, making gas supply more accessible. In the Veazie case, a pipeline is currently being constructed nearby, which presents the possibility of the wastewater treatment facility tying into the pipeline.

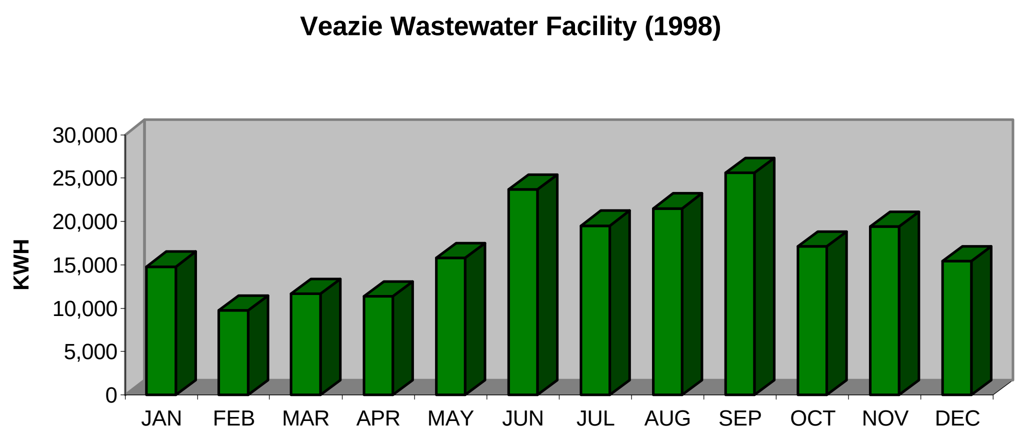
If your facility is evaluating options for future biosolids disposal, you may want to consider anaerobic digesters. The methane gas produced from digesters has long been valued as a fuel source at wastewater treatment facilities for heating and generating electricity. Similarly, landfills are a source of methane production that can be used as fuel. For further information about microturbines contact www.capstone.com .

Veazie, Maine Wastewater Treatment Facility

The Veazie treatment facility consists of headworks, aerated facultative lagoons and chlorine disinfection. The primary energy use at the facility is the aeration system where floating mechanical aerators ranging from 2 hp to 7.5 hp are used. The facility has done well operating these units with timers as needed to match lagoon oxygen requirements.

Although energy conservation opportunities are limited at the facility, the construction of a new natural gas pipeline for a nearby power generation plant provides an opportunity to explore using natural gas as an alternative energy source for the treatment facility to reduce energy costs.

Energy use for the treatment facility is shown in the graph below:



Total energy use for 1998 was 205,682 kWh for a total cost of $21,080. This amounts to an average energy cost of $0.102 /kWh.

The lagoon system offers a fairly consistent electrical demand which combined with the availability of natural gas, makes the facility a good candidate for exploring the use of new micro turbine technology as a primary power source. Micro turbine gas fired generators offer an efficient alternative to reciprocating engines typically used at treatment facilities for emergency power. Some of the advantages of micro turbines include the following:

They are designed for use as a primary continuous power source. Operating characteristics include low emissions, minimal maintenance and low noise. They include solid state power electronics to allow a parallel electric utility grid connection. The generator is cooled by air flow thus eliminating the need for liquid cooling. The units produce an oxygen-rich exhaust that can be used directly with heat exchangers to provide space heating for facilities.

Since the Veazie Sewer District is currently reviewing back-up power capabilities, the application of a micro turbine for low cost primary power, combined with the higher cost existing electric utility back-up power source, will increase system reliability.

Energy cost savings is estimated to be $8,196 annually based on the above analysis. Maintenance escrow for major overhauls is estimated at $1,000 annually. Based on an estimated installation cost of $45,000 (not including gas line installation), a simple payback of 6.3 years could be realized.

These figures are for preliminary use only. The additional benefit of using waste heat for space heating, the avoided capital cost for installing an emergency generator (planned for next year) and the cost of installing the natural gas piping from the pipeline to the facility has not been included A more detailed review with a life cycle cost analysis is recommended.

A preliminary cost benefit analysis for applying the Capstone 28 kW Micro Turbine is shown below:

Month	**Avg. kW**	**Capstone Turbine Fuel Consumption (Btu/hr)**		**Natural Gas in MCF (using a heating value of 905 Btu/cf)**	**Excess kWh Required From Electric Utility**
Jan	17.6	246,400	228		
Feb	15.0	210,000	150		
Mar	17.0	238,000	176		
Apr	17.5	245,000	175		
May	15.4	215,600	183		
Jun	29.0	410,000	358		792
Jul	30.0	410,000	293		1296
Aug	26.3	368,200	332		
Sep	29.0	410,000	391		864
Oct	31.0	410,000	250		1656
Nov	23.0	322,000	247		
Dec	18.9	264,600	238		
Total Energy Use				3021 MCF	4,608 kWh

*Total Electric Cost @$0.125/kWh and monthly fees	$800.00
**Total Fuel Cost @4.00/MCF	$12,084.00
Total Energy Cost with Micro turbine	**$12,884.00**

*The facility may be included under Bangor Hydro's general commercial rate due to a lower electrical demand

**Estimated cost for high-pressure fuel service from pipeline

Wet Weather Training

The Maine DEP is offering four courses on developing Wet Weather Operation management plans for POTWs. These courses are being offered as follows:

Augusta, September 24, 2002, Response Services Training Room
Portland, September 26, 2002, Portland Water District Training Room
Bangor, October 1, 2002, Bangor WWTF Training Room
Presque Isle, October 3, 2002, NMTC Cafeteria Conference Room

Virtually all POTWs now have or will be getting new MEPDES permits that require the development of Wet Weather Management Plans. These plans must conform to guidelines developed by the Department. The purpose of these training sessions is to help you understand the guidelines and go through the steps necessary to develop a good wet weather plan.

This training course is based on a very successful program run in New York State. They spent a great deal of time preparing this training and they have been very successful in helping the operators in their state improve wet weather treatment operations. We hope to have the same success here in Maine.

All operators attending this training will receive 6 training contact hours and lunch will be provided. If you have not yet arranged for someone from your facility to attend this training, we urge you to sign up soon. You can register by contacting Leslie Rucker at 287-9031. If you have any questions, please to contact Dick Darling at 287-7806.

Fall 2002 Exam

The Fall, 2002 wastewater operator certification exam will be given at the usual locations on November 13, 2002. Applications must be postmarked by September 28, 2002 or delivered to our office by September 30, 2002 to enroll for the exam.

Approved Training

September 17&24, October 1,8&15,2002 in Bangor, ME – Distribution Certification Prep Course – – Sponsored by MWRA, (207) 729-6569 – Approved for 9 hours. (Note: there are sections of this course that deal with topics common to water and wastewater. Wastewater operators will receive credit for sections that deal with those topics.)
*****
September 24, 2002 in East Vassalboro, ME Fall Protection: A MUST Program – Sponsored by MWRA, (207) 729-6569 – Approved for 4 hours.
*****
September 25, 2002 in Portland, ME – Security and Emergency Preparedness Workshop for Wastewater Facilities – Sponsored by EPA/NEIWPCC/NEWEA, (978) 322-7929 – Approved for 6 hours.
*****
September 26, 2002 in Portland, ME – Wet Weather Flow Management Plan Development – Sponsored by MeDEP, (207) 287-9031 – Approved for 6 hours.
*****
October 1, 2002 in Bangor, ME – Wet Weather Flow Management Plan Development – Sponsored by MeDEP, (207) 287-9031 – Approved for 6 hours.
*****
October 2, 2002 in Bangor, ME - Fall Protection: A MUST Program – Sponsored by MWRA, (207) 729-6569 – Approved for 4 hours.
*****

October 3, 2002 in Presque Isle, ME – Wet Weather Flow Management Plan Development – Sponsored by MeDEP, (207) 287-9031 – Approved for 6 hours.
****
October 3, 2002 in Houlton, ME - Confined Space Entry: Alternate Procedures c5, Reclassification c7 & Rescue and Emergency Services - A MUST Program – Sponsored by MWRA, (207) 729-6569 – Approved for 4 hours.
*****
October 10, 2002 in Bangor, ME – O&M and Troubleshooting RBC Systems – Sponsored by JETCC, (207) 253-8020 – Approved for 6 hours.
*****
October 16&17, 2002 in Presque Isle, ME – North Country Convention – Sponsored by JETCC, (207) 253-8020 – Approved for up to 12 hours.
*****
October 17, 2002 in Portland, ME – Pumping Hydraulics for Water & Wastewater Operators – Sponsored by JETCC, (207) 253-8020 – Approved for 6 hours.
*****
October 22, 2002 in New Gloucester, ME – Wastewater Planning, Operation & Maintenance – Sponsored by MRWA (207) 729-6569 – Approved for 6 hours.
*****
October 23, 2002 in Augusta, ME - Wastewater Treatment Certification Review Class IV & V – Sponsored by MWRA, (207) 729-6569 – Approved for 6 hours.

*****
October 24, 2002 in Old Orchard Beach, ME – QA/QC for Wastewater Laboratories – Sponsored by MWRA, (207) 729-6569 – Approved for 5 hours.
*****
October 29, 2002 in East Vassalboro, ME - Backflow Prevention Devices: Troubleshooting & Repairs – Sponsored by MWRA, (207) 729-6569 – Approved for 3.5 hours.

October 29, 2002 in Norway, ME - Effective Safety & Health Programming in the Utilities Industry: A MUST Program – Sponsored by MWRA, (207) 729-6569 – Approved for 4 hours.
*****
October 29&30, November 6&7, 2002 in Rockland, ME - NPDES Laboratory Procedures (4) days course – Sponsored by MWRA, (207) 729-6569 – Approved for 16 hours.
*****
October 30, 2002 in Presque Isle, ME - Wastewater Treatment Certification Review Class IV & V – Sponsored by MWRA, (207) 729-6569 – Approved for 6 hours.
*****
October 30, 2002 in Topsham, ME - Backflow Prevention Devices: Troubleshooting & Repairs – Sponsored by MWRA, (207) 729-6569 – Approved for 3.5 hours.
*****
October 30, 2002 in Livermore Falls, ME - Effective Safety & Health Programming in the Utilities Industry: A MUST Program – Sponsored by MWRA, (207) 729-6569 – Approved for 4 hours.
*****
October 31, 2002 in Augusta, ME - Wastewater Treatment Certification Review Class I - III – Sponsored by MWRA, (207) 729-6569 – Approved for 6 hours.
*****
October 31, 2002 in York, ME - Backflow Prevention Devices: Troubleshooting & Repairs – Sponsored by MWRA, (207) 729-6569 – Approved for 3.5 hours.
*****
November 4,5&6, 2002 in Brewer, ME – Wastewater Collection System & NEWEA Voluntary Certification Exam – Sponsored by NEIWPCC, (978) 323-7929 – Approved for 13 hours.
*****

November 5, 2002 in Presque Isle, ME - Wastewater Treatment Certification Review Class I - III – Sponsored by MWRA, (207) 729-6569 – Approved for 6 hours.
*****
November 6, 2002 in Bangor, ME - Backflow Prevention Devices: Troubleshooting & Repairs – Sponsored by MWRA, (207) 729-6569 – Approved for 3.5 hours.
*****
November 7, 2002 in Houlton, ME - Backflow Prevention Devices: Troubleshooting & Repairs – Sponsored by MWRA, (207) 729-6569 – Approved for 3.5 hours.
*****
November 16, 2002 in Mexico, ME - Confined Space Entry: Alternate Procedures c5, Reclassification c7 & Rescue and Emergency Services - A MUST Program – Sponsored by MWRA, (207) 729-6569 – Approved for 4 hours.
*****
November 19, 2002 in Ellsworth, ME – QA/QC for your Laboratory Equipment & Establishing a Laboratory QA/QC Program - Sponsored by JETCC, (207) 253-8020 – Approved for 6 hours.
*****
November 21, 2002 in Augusta, ME – Biological Nutrient Removal – Sponsored by JETCC, (207) 253-8020 – Approved for 6 hours.
*****
December 3&4, 2002 in Freeport, ME - MRWA Annual Conference – Sponsored by MWRA, (207) 729-6569 – Approved for TBA hours.
*****
December 4, 2002 in Livermore Falls - ME Polymer Sealants for use in Water & Wastewater Facilities along with ORP & pH Consideration - Sponsored by JETCC, (207) 253-8020 – Approved for 6 hours.
*****
December 10, 2002 in North Vassalboro - Advanced use of Databases for Water & Wastewater Operators - Sponsored by JETCC, (207) 253-8020 – Approved for 6 hours.

For Practice

1. Which laboratory test should be used to analyze grit to determine the effectiveness of a grit removal system?
   a. Percent total solids
   b. Percent total volatile solids
   c. Total settleable solids
   a. Total suspended solids

2. The brake horsepower rating of an electric motor is less than the motor horsepower of the same motor because.
   a. A motor is not 100% efficient
   b. A pump is more efficient than a motor
   c. A pump is not 100% efficient
   d. The specific gravity of water is greater than 1.0

3. To determine the amount of organic material in wastewater, you should run...
   a. the pH test
   b. the residual chlorine test
   c. the BOD test
   d. the total suspended solids test

4. The bast way to manage hazardous waste is...
   a. Storage
   b. Treatment
   c. Disposal
   d. Source Reduction

Calculating Percent Removal for BOD and TSS

The EPA requires that percent removal calculations, where they are required in you permit, must be computed using the monthly average influent and effluent ***concentration*** values not the monthly average ***loading*** in pounds. The DEP 49 Form Excel template that had been posted on the DEP's web site and distributed to many POTW operators, uses the ***loading*** (pounds) values to calculate the percent removal for both BOD and TSS. If you have been using the form from the DEP's web site, you can go to the site (http://www.state.me.us/dep/blwq/docstand/wastepage.htm) and download the new version of the Excel 49 Form. Or you can "fix" the problem by changing the formulas in the percent removal calculations to reference the monthly average concentration rather than the monthly average loading. If you have questions, contact Dick Darling at 287-7806.

Use of NODI Codes

Any facility that reports the results of its wastewater sampling efforts to the State and Federal governments on Discharge Monitoring Reports (DMRs) may occasionally need to use NODI codes. Most people think of these as "no discharge" codes, but the acronym actually comes from the term "no data indicator" codes. If you think about that for a few seconds, "no data" includes more situations than "no discharge", giving more flexibility to describe instances where data is not available.

These codes should be used when the data is not available to fill out a DMR or an individual parameter block or line on the DMR. The appropriate situations for the use of NODI codes include no discharge of effluent, sampling problems, seasonal discharges or changes in reporting requirements based on permit conditions.

When there is no data for a given outfall and therefore none of the parameters on a DMR page can be entered, there is a NODI box up in the right corner of the DMR in which the appropriate code can be entered. When part of the testing for an outfall is not completed, the NODI acronym should be printed across the parameter row or within the single box along with the appropriate NODI code. If you use a NODI code, do not enter values for Frequency of Analysis or Sample Type for that row.

Along with writing in the acronym NODI and/or the appropriate code, the comments area of the DMR should include an explanatory note on the situation that necessitated the use of NODI coding.

A listing of the NODI codes is included as appendix E in the DMR Instructions document that is produced by EPA. The latest update to this document was made in 2002, and can be found at the following web address: www.epa.gov/region01/compliance/enfdmr.html. This instruction manual includes comprehensive instructions for completion of all calculations and entering data fields on the DMRs.

Most of the definitions for the NODI codes are self-evident, but some explanation may help for a few of the codes. For those who do not wish or are unable to use the website, I have reprinted most of the NODI codes below. Codes L, N, R and 7 are for EPA/State use only. There are no codes B, O or P.

NODI Codes
Code Definition

A general permit exemption - *This would be used where the conditions of a general permit, which is applicable to a category of discharge rather than to an individual facility,*
C no discharge
D lost sample
E analysis not conducted
F insufficient flow for sampling
G sampling equipment failure
H invalid test - *This should be used when QA/QC requirements for the test are not met, or where improper methods of testing are used.*
I land applied waste water - *For many licensees, there are reporting requirements specific to land application. This code should be used only by facilities that have conditions allowing discharge to receiving water under some conditions, and requiring land application at others.*
J recycled, water-closed system
K flood disaster
M not applicable during sludge monitoring period
Q not quantifiable

1 wrong flow - *Used where different limits or reporting requirements apply depending on flow rate*
2 operations shutdown
3 low level production
4 lagoon processing
5 frozen conditions
6 production-based limits don't apply to monitoring period
8 other
9 monitoring conditional/not required this monitoring period

Phil Garwood

Answers to *For Practice:*

1. b If the total volatile solids is high, the grit chamber is removing too much settleable material. Grit chambers should remove mostly non-volatile solids. Volatile solids are normally less dense than non-volatile solids and should not settle in the grit chamber.

2. a No motor can convert all of the electrical energy input to mechanical energy output. Some of the energy is lost to heat and is not available to do the work of the pump, moving a fluid against a pressure head.

3. c The BOD test is the best of the listed methods to determine the amount of organic matter in a water sample. Bacteria will use the organic matter as food and consume oxygen. By measuring the amount of oxygen used, you can estimate the amount of organic matter present.

4. d Reducing the amount of hazardous material used in a process is always better than having to handle, treat and dispose of that material.